physical properties, between isomorphous substances and gases, is suggested; and a law similar to Avogadro's may be applicable, viz., equal volumes of those (isomorphous) substances must contain the same number of molecules. In verification of this is the fact shown by M. Spring, that the quotients of the specific weights of the alums by the respective molecular weights are equal. Thus the law of Avogadro, verified hitherto in its consequences only for gases, may be found to strike its roots even into solid bodies, and the problem of determining the molecular magnitudes of the latter may one day receive a solution conform ably to modern theories of chemistry. M. Spring is extending his examination to other isomorphous substances, and will also study the ratio of expansion and contraction in heteromorphous bodies.

THE third instalment of Dr. Hermann Müller's "Further Observations on the Fertilisation of Flowers by Insects" is occupied by observations, supplementary to those recorded in his "Befruchtung der Blumen durch Insekten," on the insects which visit particular species and assist in their pollination, with some notes on corresponding peculiarities of structure in the flowers themselves. It is illustrated by a very beautifully executed plate.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Lady Parkyns; an Egyptian Fox (*Canis niloticus*) from Egypt, presented by Mr. Horace Kemp; two Coypu Rats (*Myopotamus coypus*) from South America, two Common Night Herons (*Nycticorax griseus*), European, presented by Mr. A. A. van Bemmelen; two Californian Quails (*Callipepla californica*) from California, presented by Mr. J. Biehl; a Crocodile (*Crocodilus*, sp. inc.) from Black River, presented by Mrs. A. H. Jamrach; an Æsculapian Snake (*Coluber æsculapii*) from Central Europe, presented by Lord Arthur Russell, M.P.; two Australian Fruit Bats (*Pteropus poliocephalus*), a Black-breasted Peewit (*Sarciophorus pectoralis*), an Australian Monitor (*Monitor gouldi*) from Australia, two Porto Rico Pigeons (*Columba corensis*) from the West Indies, a South American Jabiru (*Mycteria americana*), two Brown Thrushes (*Turdus leucomelas*) from South America, two Demoiselle Cranes (*Anthropoides virgo*) from North Africa, three Blue-shouldered Tanagers (*Tanagra cyanoptera*), a Striated Tanager (*Tanagra striata*), a Tanager (*Saltator*, sp. inc.) from Brazil, two Scops Owls (*Scops asio*) from North America, two Yellow Sparrows (*Passer luteus*) from East Africa, two Beautiful Waxbills (*Estrelda formosa*) from India, purchased; a Two-spotted Paradoxure (*Nandinia binotata*), a Hybrid Sclater's Muntjac (between *Cervulus muntjac* ♀ and *Cervulus lacrymans* ♂), born in the Gardens. The following insects have emerged in the Insect House during the past two weeks:—Silk Moths: *Actias selene*, *Telea polyphemus*, *Telea promethea*; Moths: *Ceratocampa imperialis*, *Bombyx castrensis*, *Zygæna filipendulæ*, *Liparis monacha*, *Deilephila vespertilio*, *Deilephila euphorbiæ*, *Bembecia hylæiformis*, *Plusia concha*; Butterflies: *Parnassius apollo*, *Melanagria galathea*, *Goneopteryx rhamni*, *Vanessa io*, *Vanessa polychlorus*, *Araschnia levana* var. *prorsa*, *Theela betulæ*, *Theela spina*, *Epinephele janira*, *Erebia blandina*.

OUR ASTRONOMICAL COLUMN

THE WEDGE PHOTOMETER.—In a communication to the American Academy of Arts and Sciences in May last (NATURE, vol. xxvi. p. 259), Prof. Pickering has some remarks upon the use of a wedge of shaded glass as a means of measuring the light of the stars. He considers that, while it has been maintained by some writers that it is not a new device, "the credit for its introduction as a practical method of stellar photometry seems clearly to belong to Prof. Pritchard, director of the University Observatory, Oxford." Various theoretical objections to this photometer have been advanced, and many sources of error suggested, but Prof. Pritchard has made the best possible reply to them by measuring a number of stars, and showing that his results are in very close agreement with others obtained elsewhere by wholly different methods. His photometer "consists of a wedge of shade glass of a neutral tint inserted in the field of the telescope, and movable, so that a star may be viewed through the thicker or thinner portions at will. The exact position is indicated by means of scale." The measure of the brightness of the star is made by bringing it to the centre of the field and moving the wedge from the thin towards the thick end until the star disappears. Stars must always be kept in the centre of field to insure the readings being comparable. But Prof. Pickering makes the ingenious suggestion that this photometer may be further simplified by substituting the earth's diurnal motion as a measure of the position of the star in the wedge at disappearance. "It is only necessary to insert in the field a bar parallel to the edge of the wedge, and place it at right angles to the diurnal motion, so that a star in its transit across the field will pass behind the bar and undergo a continually increasing absorption as it passes towards the thicker portion of the wedge. It will thus grow fainter and fainter, until it finally disappears." Then the interval of time from the passage behind the bar until the star ceases to be visible becomes a measure of its light, and the time will vary with the magnitude. As in Prof. Pritchard's form of the instrument, it is only necessary to determine the value of a single constant. Prof. Pickering adds some suggestions with regard to observations with this photometer, and recommends them to the attention of amateurs.

THE OBSERVATORY IN YALE COLLEGE, U.S.—Prof. H. A. Newton, who was appointed Director of the Winchester Observatory in Yale College, New Haven, U.S., in May last, has drawn up a report on the present state of this establishment, and of the preparations in progress for placing the instruments in new buildings specially erected to receive them. The heliometer ordered from Repsold, of Hamburg, two years since, was received last spring; the cost, including freight, and other expenses to New Haven, being close upon 7460 dollars. To supplement the heliometer, and also for independent work, an equatorial telescope of 8 inches diameter was ordered from Mr. Howard Grubb of Dublin, and is expected in August. (No mention is made by Prof. Newton of the 9-inch Alvan Clark refractor, which Yale College was stated to possess in the Smithsonian report on astronomical observations in 1880). About nine acres from the southern extremity of the observatory lands have been set apart as a site for the observatory, and the erection of two towers for the heliometer and equatorial respectively, has been commenced. The heliometer tower was expected to be ready for the instrument early in July, the dome constructed by Mr. Grubb having been already put in place. It is intended by Prof. Newton to undertake such work with it, immediately it is available, as shall prepare for the most advantageous use of the instrument during the approaching transit of Venus. In the Smithsonian report referred to, the diameter of the object-glass is stated to be 6 inches.

The income derived from the fund set apart by the late Hon. O. F. Winchester, is to be applied for the maintenance of the observatory. The 8-inch equatorial has been purchased from funds generously provided by a private individual, who for the present does not desire his name to be mentioned. Under the direction of Prof. H. A. Newton, supported by such liberality, astronomers will look forward to a bright future for the "Observatory in Yale College"—as, with the assent of Mr. Winchester's family, the institution is to be called.

THE TRANSIT OF VENUS.—In consequence of the sudden death of Mr. Burton, who, as we mentioned last week, had been appointed observer at Aberdeen Road, Cape Colony, we understand Mr. A. Marth will have charge of that station.

It is not improbable that some readers may contemplate proceeding for the purpose of observing this phenomenon (which will not recur till the year 2004), where it is visible from ingress to egress, and perhaps with a view at the same time of escaping a winter in this climate. If such there be, they might not readily fix upon a more advantageous station than the Blue Mountain range in the island of Jamaica or its vicinity. Calculating for a point in longitude 77° 30′ W., latitude 18° 5′ N., the times of contacts and sun's altitudes are as follows:—

	Local mean time.	Sun's altitude.
	h. m. s.	° ′
First external contact, Dec. 6	8 52 37 a.m.	30 15
,, internal ,, ,,	9 13 23 a.m.	33 54
Last internal ,, ,,	2 39 5 p.m.	32 17
,, external ,, ,,	3 0 22 p.m.	28 29

WELLS' COMET.—The following places of this comet are for Greenwich midnight :—

	R.A.	Decl.	Log. distance from Earth.	Log. distance from Sun.
	h. m. s.	°		
July 27	11 39 1	+5 58·7	0·2614	0·1380
29	11 44 41	5 38·3	·2732	·1506
31	11 50 5	5 18·5	·2867	·1626
August 2	11 55 14	4 59·3	·3004	·1742
4	12 0 9	4 40·6	·3126	·1853
6	12 4 51	4 22·7	·3244	·1960
8	12 9 22	4 5·2	·3358	·2064
10	12 13 43	3 48·2	·3469	·2164
12	12 17 54	3 31·7	·3576	·2260
14	12 21 56	+3 15·7	0·3680	0·2354

The calculated intensity of light on August 9 is equivalent to that at the first Harvard College observation on March 19.

COMET-SEEKING IN THE SOUTHERN HEMISPHERE.—From a communication to the *Sydney Morning Herald*, we learn that Mr. Tebbutt, of Windsor, N.S.W., the discoverer of the great comet of 1861, has, at the instance of the Boston (U.S.) Scientific Society, undertaken the organisation of a corps of amateur comet-seekers in Australia, and with this object has addressed a circular to several persons in the colonies, who have manifested an interest in the science. We wish Mr. Tebbutt every success: the matter could not be in better hands. It would be easy to adduce numerous cases where the theories of these bodies have suffered from the want of southern observations, and it may be hoped, that in conjunction with the systematic search undertaken by a number of observers in America, and, we are glad to add, in this country also, it will be quite an exceptional case for a comet within range of ordinary telescopes to escape detection, as we know many have done in past years. The additions to the number of comets of short period during the last fifteen years, are alone a sufficient inducement to institute more systematic examination of the heavens in future.

PHYSICAL NOTES

AN organ-pipe sonometer is described in the *American Journal of Science*, by Mr. Le Conte Stevens. The ordinary resonance box of the sonometer is in this instance replaced by a double organ-pipe of spruce fir-wood, tuned to give the note C=132 vibrations. Three steel wires are stretched above, two being tuned to the fundamental, the other strained to various degrees of tension by a lever and a sliding weight. There are also arrangements for sharpening or flattening the note of one of the pipes at will, so as to produce beats. By varying the wind-pressure, the natural harmonics of the pipes can be produced. The object of the instrument is to afford a convenient means of producing the notes of the natural scale and those of the tempered scale, by way of contrasting them with one another. The apparatus has several other uses as a lecture instrument in acoustics.

M. CAILLETET has invented a new pump for compressing gases to a high degree of compression. The main point in its construction is the method by which he obviates the existence of useless space between the end of the piston-plunger and the valve, which closes the end of the cylinder. This he accomplishes by inverting the cylinder and covering the end of the plunger with a considerable quantity of mercury. This liquid piston can of course adapt itself to all the inequalities of form of the interior space, and sweeps up every portion of the gas, and presses it up a conical passage into the valve. The valve by which the air enters the body of the pump is opened by a cam-gearing after the descent of the piston below point where the air rushes in.

ANOTHER suggestion due to M. Cailletet is worthy of notice, and is applicable to many pieces of laboratory apparatus beside air-pumps. It is the employment of *vaseline* as a lubricant wherever there is a liability of the presence of mercury; for, as is known, most oils and fatty matters clog with finely-divided mercury, and are objectionable on this account.

NEW forms of secondary battery continue to make their appearance, most of them based upon the accumulator of Planté. Mr. R. E. Crompton has lately patented a process for giving a large effective surface to the leaden electrodes by making it porous, by adding to the lead some other substance capable of being extracted by the action of acid, or by heat, or by other reagents. Another modification due to Messrs. Biggs and Beaumont, consists in collecting in a separate vessel the hydrogen or other products of decomposition, in the accumulator, the collected products being afterwards recombined as fast as required. The electrodes in this case are composed of finely divided lead.

WE have also received a report of a lecture delivered by M. Maurice Lévy before the Societé d'Encouragement on the same subject of electrical units. It speaks volumes for the mathematical education given in the public schools of Paris, if an audience of a society comparable to that of our Society of Arts could follow the lecturer through a mathematical discussion like that before us, which includes a discussion of the doctrine of dimensional equations, and of the elimination of arbitrary coefficients. M. Lévy applauds the decisions of the Congress, which he expounds logically and elegantly.

THE following experiment of Messrs. Jamin and Maneuvrier illustrates the presence of an inverse electromotive force in the voltaic arc, dependent on the actions therein excited by the current. A continuous current was passed first from coke to mercury, producing a reddish coloured arc. The current was then reversed, when the arc appeared green, and the metal volatilised rapidly. Then the current of an alternating Gramme machine was passed through the same arrangement. The arc now appeared green, showing a predominance of the current from mercury to coke, although in ordinary circumstances the two alternately directed currents are absolutely equal in strength.

THE decisions of the Electrical Congress have aroused the electricians of several Continental nations to realise the advance in exact science which the adoption of a uniform system of electrical units implies; and not to be behindhand, they are striving to spread a knowledge of what has been done. The new determination which is to be made of the value of the ohm has furnished material for several discussions, in which it is curious to observe the suggestions that were brought forward as new. Others content themselves with expounding that which has been already done. We have before us, from the pen of Dr. Guglielmo Mengarini, assistant in the Physical Institute of the University of Rome, a "History of the Electromagnetic Unit of Resistance," reprinted from the official bulletin of the Minister of Public Instruction. Beginning with the work of Davy, Becquerel, Ohm, and Wheatstone, the author describes how gradually the rheostat brought forth the resistance-coil, and the units of Siemens and of the British Association. He then gives a theoretical discussion of the absolute electromagnetic unit of resistance, and an account of the methods of Weber and of the British Association for determining it. The main points in the propositions submitted to the International Congress at Paris in 1881 are then given, together with the formal decisions of the Congress thereupon.

A VALUABLE contribution to the subject of the electricity of flame has been lately made by Herren Elster and Geitel (*Wied. Ann.* No. 6). The discrepancies in previous results are attributed largely to the behaviour of the air layer immediately outside of the flame having been left out of account. The authors used a Thomson quadrant electrometer for measurement. They find the supposed longitudinal polarisation of flame merely apparent, and due to unequal insertion of the wires used as electrodes. On the other hand, flame is strongly polarised in cross section; an electrode in the air about the flame is always positive to one in the flame. The theory the authors adopt is this :—By the process of combustion *per se* free electricity is not produced in the flame; but the flame-gases and the air-envelope have the property of exciting, like an electrolyte, metals or liquids in contact with them. To this electrolytic excitation is added a thermo-electric, due to the incandescent state of the electrodes. The amount and nature of the electric excitation is independent of the size of the flame, and dependent on the nature, surface-condition, and glow of the electrodes, and on the nature of the burning gases. *Inter alia*, it is remarked that flames may be combined in series like galvanic elements, and so as to form a "flame-battery."

IN a recent dissertation (*Wied. Ann.* No. 7), Herr Heine describes experiments on the absorption of heat by gas-mixtures with varying percentage of constituents, and he thence deduces a method of ascertaining the amount of carbonic acid in the air. Varied mixtures of CO_2 and air, in known proportions, were